

Algorithm EXPECTATION-MAXIMIZATION (EM)

Input Data $\mathcal{D} = \{x_i\}_{i=1:n}$, number clusters K

Initialize parameters $\pi_{1:K}$ $\mu_{1:K}$, $\Sigma_{1:K}$

Iterate until convergence

E step (Optimize clustering) for $i = 1 : n$, $k = 1 : K$

$$\gamma_{ki} = \frac{\pi_k f_k(x)}{f(x)}$$

M step (Optimize parameters) let $\Gamma_k = \sum_{i=1}^n \gamma_{ki}$, $k = 1 : K$
(note: $\sum_k \Gamma_k = n$)

$$\begin{aligned}\pi_k &= \frac{\Gamma_k}{n}, \quad k = 1 : K \\ \mu_k &= \sum_{i=1}^n \frac{\gamma_{ki}}{\Gamma_k} x_i \\ \Sigma_k &= \frac{\sum_{i=1}^n \gamma_{ki} (x_i - \mu_k)(x_i - \mu_k)^T}{\Gamma_k}\end{aligned}$$